Request for an exempted fishing permit (EFP) to conduct research on Chinook salmon bycatch reduction device for the Central Gulf of Alaska pollock fishery

Date of Application: October 6, 2012

Name, mailing address, and phone number of applicant:

Signature of Applicant:

EFP Applicant and Principal Investigator:
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Purpose and Objectives of the EFP: This application requests the Alaska Region of the National Marine Fisheries Service (NMFS) issue an exempted fishing permit allowing the applicant to conduct research on a bycatch reduction device (AKA excluder) to reduce catch rates of Chinook salmon in the Central Gulf of Alaska (CGOA) pollock fishery. The primary objective of the research is to make stepwise adjustments to a flapper-design salmon excluder that has been developed for the Bering Sea pollock fishery. This excluder design has been shown to be effective for reducing Chinook bycatch rates in the Bering Sea without significant negative effects on pollock fishing and it is being widely used there. From our Bering Sea experience with excluder development, we expect that differences in vessel horsepower, fishing methods/practices, and relative size differential between pollock and salmon in the CGOA pollock fishery will require adjustments to the excluder to achieve effective selectivity. Additionally, based on the scope of effort it has taken to fashion a workable excluder for Chinook in the Bering Sea, we expect that adaptation of the excluder to the GOA pollock fishery will take more than one year and our EFP application reflects this expectation.

Relevant Background information: In the GOA, Chinook salmon bycatch primarily occurs in the Western and Central Gulf of Alaska pollock trawl fisheries with the majority of Chinook bycatch occurring in the Central Gulf of Alaska. The single year when the Central Gulf region has not been the dominant area for GOA Chinook bycatch was in 2010 when over 31,000 Chinook were reportedly taken in the Western Gulf of Alaska (WGOA) pollock fishery. To illustrate trends in Chinook bycatch in the GOA pollock fishery, Tables 1 and 2 below show annual, region-specific (CGOA, WGOA) Chinook salmon bycatch numbers and rates from 1994 to 2011. These tables were taken directly from the North Pacific Fishery Management Council's (NPFMC) GOA Chinook bycatch 2011 analysis available at: http://www.fakr.noaa.gov/npfmc/PDFdocuments/bycatch/ChinookBycInGOAtrawl1111.pdf).

Table 1. CGOA Chinook PSC and pollock harvests, 1994 - 2011

Area	Year	Chinook PSC	Pollock Harvest (mt)	Chinook/mt pollock
CGOA	1994	6,589	84,130	0.08
	1995	3,051	38,897	0.08
	1996	10,598	26,450	0.40
	1997	8,800	57,862	0.15
	1998	10,464	88,136	0.12
	1999	23,758	68,275	0.35
	2000	15,907	47,691	0.33
	2001	8,234	37,663	0.22
	2002	2,487	31,437	0.08
	2003	3,557	31,290	0.11
	2004	10,655	38,311	0.28
	2005	21,429	46,802	0.46
	2006	11,138	42,299	0.26
	2007	31,647	32,205	0.98
	2008	7,971	30,769	0.26
	2009	2,123	22,700	0.09
	2010	12,334	44,033	0.28
	2011	6,839	56,920	0.12
03-'11 CG Avg.		**11,966**	**38,370**	**0.31**

Table 2. WGOA Chinook PSC and pollock harvests, 1994 - 2011

Area	Year	Chinook PSC	Pollock Harvest (mt)	Chinook/mt pollock
WGOA	1994	591	19,894	0.03
	1995	1,506	30,958	0.05
	1996	565	24,200	0.02
	1997	524	26,141	0.02
	1998	3,448	29,301	0.12
	1999	2,307	23,384	0.10
	2000	2,472	22,074	0.11
	2001	1,237	30,471	0.04
	2002	2,548	17,455	0.15
	2003	738	15,970	0.05
	2004	2,327	23,124	0.10
	2005	5,951	30,756	0.19
	2006	4,529	24,427	0.19
	2007	3,359	17,303	0.19
	2008	2,116	14,828	0.14
	2009	441	14,010	0.03
	2010	31,581	25,766	1.23
	2011	2,049	20,594	0.10
03 - '11 WG Avg.		**5,899**	**20,753**	**0.28**

Reviewing the data in the tables above, it is evident that there is considerable annual variability in both the Western and Central GOA reported Chinook bycatch. Overall, however, GOA Chinook bycatch does not seem to be correlated with amount of pollock harvested annually but does seem to be somewhat cyclical. The pattern appears to be three to four year period of relatively high Chinook bycatch numbers followed by three to four years of relatively low bycatch. This is particularly true for the Central Gulf of Alaska management area and it could reflect trends in salmon abundance and run strength. Other factors such as observer coverage levels and observer sampling methods, however, make the identification of trends or patterns through bycatch data difficult.

Further, according to the NPFMC's 2011 GOA salmon bycatch analysis, the majority of Chinook salmon bycatch is taken in the pollock target fishery – accounting for about 87% of all Chinook salmon bycatch in the Western GOA between 2003 and 2011, and 71% in the Central GOA according to the NMFMC's 2011 GOA Chinook bycatch analysis.

For the CGOA, the North Pacific Council recently approved a hard cap of 18,316 Chinook for the Central GOA pollock fishery. Figure 1 below compares the new cap to the historical bycatch data within the areas to which the cap applies. It is clear that the CGOA hard cap will be potentially constraining to the pollock fishery in the Central Gulf of Alaska assuming historic salmon abundance and bycatch patterns are indicative of what that fishery will encounter following the expected implementation of the hard cap in mid-2012. Specifically, the CGOA bycatch numbers have exceeded the 18,316 annual cap three times over the time series 1994-2011.

In the WGOA, where a hard cap of 6,684 salmon was recently approved by the NPFMC, that level of Chinook catch was exceeded only once in the time series - in 2010 (Figure 2). Both figures below are reproduced from pages 56-57 of the NPFMC's 2011 GOA Chinook bycatch analysis.

Figure 1

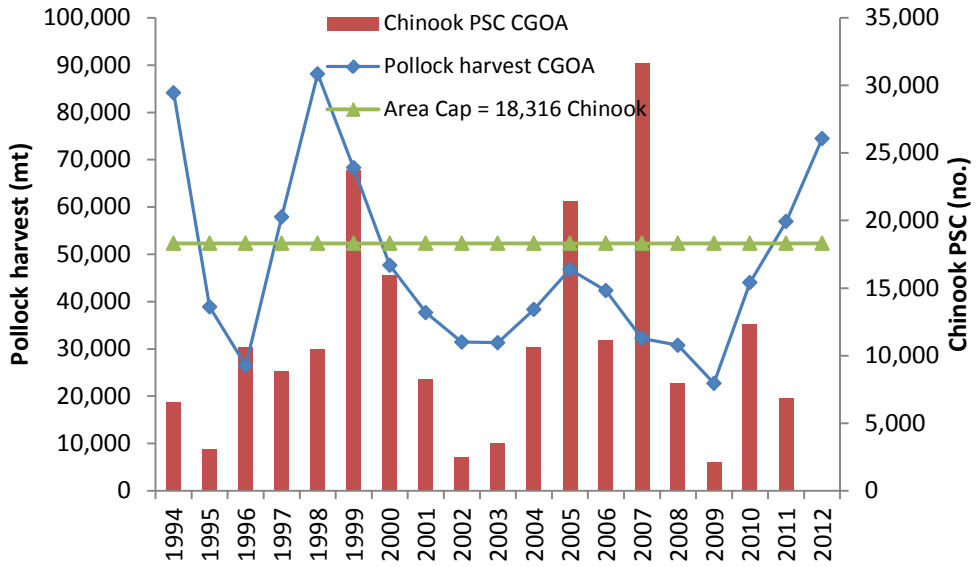
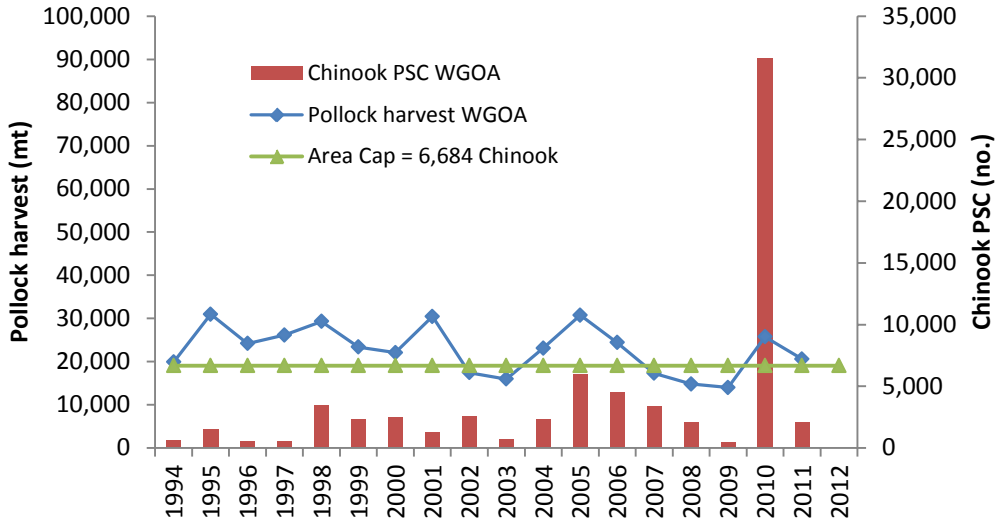


Figure 2



From the above information, it is evident that development of additional tools to help control Chinook bycatch in the Gulf of Alaska should be a high priority. One tool that could be important would be an effective gear modification (a "salmon excluder") if it can allow a significant portion of the Chinook salmon that enter the trawl to escape unharmed. This would provide pollock fishermen a means of reducing bycatch rates thus helping to prevent exceeding the hard cap. An effective excluder could also help mitigate the added costs of bycatch avoidance such as additional fuel usage and running time needed to avoid salmon on the grounds. In the extreme, an effective excluder could even be a plus for vessel safety as it might allow fishermen to conduct fishing closer to port which might not otherwise have been possible due to salmon bycatch rates in those areas.

As in the Bering Sea, the selectivity gains from using an excluder are not expected to remove the need for additional bycatch avoidance measures such as hotspot reporting and avoidance to control salmon bycatch. But if rates can be reduced by the degree shown to occur in the Bering Sea, for example, the economic effects of the hard cap might be reduced thereby preserving profitability in the fishery. To this end, this exempted fishing permit application has been drafted as a logical extension to the work on salmon excluders in the Bering Sea pollock fishery.

Starting in 2003, the principal investigator and EFP applicant on this project has conducted research and field testing to develop an effective and feasible gear modification to reduce salmon bycatch in the Bering Sea pollock fishery. This proposed EFP and the earlier EFP work in the Bering Sea have been done in conjunction with Dr. Craig Rose of the Alaska Fisheries Science Center's RACE Division and Mr. John Gruver of the United Catcher Boats Association. Additionally, all the EFP fieldwork has included a high level of collaboration and input from interested fishermen and gear manufacturers. Following the successful use of collaboration with industry in the Bering Sea, the proposed EFP work in the Gulf of Alaska will work closely with the Alaska Groundfish Data Bank and the Alaska Whitefish Trawlers Association.

The most current research on the Bering Sea salmon excluder has shown a Chinook bycatch reduction range of 25 to 40%. That percent reduction, measured in multiple controlled experiments, is based on what Chinook catches would have been by the same vessel in the same area but without an excluder. The same research has consistently concluded that pollock escapement with the use of the excluder at well under one percent.

Equally encouraging is the finding that the current Bering Sea excluder design appears to create little or no associated problems with pollock fishing under normal fishing conditions. This includes avoiding damage to the net even under high catch rates and requiring little to no maintenance or active behavior such as slowdowns at haulback associated with use of the excluder on a regular basis. Problems of this sort occurred with the early designs of salmon excluders, particularly with larger vessels with greater horsepower. Resolution of these issues through the design advantages of the "flapper style" excluder involved a three year process to develop and field test the flapper excluder in the Bering Sea. At each step, adjustments were made to address problems as they became evident and to increase escapement performance as salmon behavior in response to the excluder became better understood.

The current flapper excluder has been adopted into the regular fishing operations of a large fraction of Bering Sea catcher vessels and catcher processors. Most pollock fishermen feel the device provides an effective tool they can utilize as part of an overall suite of steps they take to remain under the Bering Sea Chinook salmon hard cap implemented in 2011.

With word of the progress in the Bering Sea, considerable interest has been expressed by pollock fishermen in Kodiak regarding development of a flapper excluder for the GOA pollock fishery. Having heard that the effectiveness of the excluder depends on proper weighting, location in the trawl, and other factors such as the length of the flapper panel, we have received numerous enquiries regarding the sizing and other factors that affect performance of the excluder. At this point we are unable to provide informed guidance on these specifics for the Gulf of Alaska.

Our experience with development of the Bering Sea salmon excluder has shown that the excluder design must be specifically adjusted to be effective, based on the specifics of the net, horsepower and towing speed of the vessel using the device. These vessel-size specific differences have required different weighting on the flapper panel as well as in some cases different location of the excluder in the net. Excluder designs prior to the flapper excluder were also highly dependent on vessel size and towing power. In the extreme, we even discovered that larger vessels experienced a high level of problems with one excluder design while smaller vessels reported they were able to use that same excluder with little or no negative effect on fishing.

Testing in the Bering Sea has also underscored that the effectiveness of an excluder design depends greatly on careful and stepwise adjustments and field testing to verify proper shape while deployed. Documentation of salmon and pollock escapement rates with a recapture net appended to the trawl has also been critical to the successful development of the excluder. We feel that had we not used this systematic approach the result might have been abandonment of some excluder designs before their effectiveness was fully evaluated and realized. This systematic approach has also helped us gain the confidence of fishermen who were sometimes skeptical regarding the potential effectiveness and practicality of excluders, paying dividends in terms of getting input from fishermen and gear manufacturers as Beta testing of concepts and different excluder designs was undertaken.

In considering the most effective way forward in the GOA, we fully expect that there will be some important similarities in salmon behavior and factors affecting excluder performance in the GOA pollock fishery. At the same time, we also envision that what has worked in the Bering Sea will require adjustments to take into account differences in horsepower for GOA boats, net size, and towing speed**.** We also expect that there will be differences in the relative swimming ability of pollock and salmon that will need to be factored into the design of the excluder for the Gulf of Alaska. Another difference may result from the fact that a higher proportion of day fishing occurs in the Gulf relative to the Bering Sea. To take into account all these dissimilarities, excluder development in the GOA will need to incorporate what has been learned in the Bering Sea while remaining cognizant that the GOA pollock fishery is different.

The salmon catch data above show that the CGOA Pollock fishery is potentially more likely to be constrained by the new hard bycatch cap that in the WGOA. This was one factor in our decision to focus on the CGOA in this initial effort in the Gulf of Alaska. Another reason for starting in the CGOA is that we expect that experience gained in the Bering Sea will be more easily and directly transferable to Kodiak-size vessels (and nets) than vessels in the Western Gulf of Alaska. While CGOA pollock vessels are generally considerably smaller than even the smaller range of the Bering Sea pollock fleet, Central Gulf pollock boats are still closer in horsepower and net size to Bering Sea boats than Western GOA boats which are mostly 58 foot "limit seiner" vessels that have been converted to trawling.

Additionally, CGOA pollock fishermen, through the Alaska Groundfish Data Bank and Whitefish Trawlers association, have expressed an interest in having our assistance with excluder development. For instance, in winter of 2011 a technician who has been involved in the Bering Sea EFPs was invited to go out on several different Kodiak boats to take underwater video footage of pollock and salmon moving through a pollock net. Some of the vessels were using flapper-style excluders they had installed themselves. This video footage is expected to yield insights into where to start in this GOA EFP in terms of flapper panel location and weighting. Even so, we expect that excluder development will present challenges. This was reinforced when several of the Kodiak vessels that had installed excluders and done some testing on their own reported anomalies in terms of catch rates for pollock, net deployment, and salmon catch rates.

Names of participating vessels, copies of vessel Coast Guard documents, names of vessel masters:
The EFP application incorporates two field testing seasons (winter/spring and fall) during two separate years (2013 and 2014) for a total of four field testing seasons. Testing will be conducted by two test vessels of different sizes in each field season. Vessels for the EFP testing have not been selected yet. A request for proposals (RFP) process will be conducted by the principal investigator (permit holder) to inform potential applicants of the requirements of the EFP testing and other relevant information. Vessel proposals will include general information about the facilities of the vessel and experience level of the crew. Additionally, applications will need to provide specific information on how the applicant would carry out the catch handling and accounting duties of the EFP on that proposed vessel. With this information, a panel of AFSC scientists with experience in reviewing vessel charter applications and knowledge of catch handling and sampling challenges on CGOA trawl vessels will review applications and rank them for suitability/appropriateness for the objectives of the EFP. Individuals from the Alaska Regional Office and NMFS Observer Program (FMA) with expertise on catch sampling and accounting on GOA catcher vessels will also be invited to serve on/provide input in the selection of vessels for the EFP. Following that process and once the EFP vessels have signed an agreement to confirm they will meet the requirements of and participate in the EFP, the principal investigator will notify the Alaska Regional Administrator (or his agent) of the names of the EFP vessels including all required vessel and vessel

owner contact information. The principal investigator will also inform NMFS of the timeline for field testing for each field season.

Exemptions needed to regulations affecting regular pollock fishing during 2013:

1. Exemption from regular observer coverage requirements for vessels selected to participate in our salmon excluder EFP field tests. Vessels engaged in EFP testing will carry one or two sea samplers depending on the data collection requirements of the project, testing schedule and anticipated workload for sea samplers, available accommodations on the EFP vessel, and facilities available for accounting for salmon catches by tow, at-sea versus dockside. The exemption from the regular observer coverage and ability to modify catch sampling procedures has been important to the utility of the data collected in past salmon excluder EFPs.
2. All groundfish and salmon catches during the EFP will not count against the regular groundfish GOA TACs or Chinook salmon bycatch cap (when in place). This is needed to allow the testing to occur in a systematic manner under a prescribed test fishing protocol which is expected to reduce EFP vessel efficiency and will restrict the amount of catch per tow relative to normal fishing operations. For those reasons, the EFP test fishing protocol would be infeasible in the regular pollock fishery especially given the lack of assigned shares (catch share program).
3. Exemption from the 300,000 lb pollock trip limit (50 CFR 679.7(b)(2)) while participating in the EFP testing. The EFP testing protocol will limit catch per tow and other aspects of efficiency for the purpose of increasing the number of test tows and the range of conditions under which testing is done. It is hoped that by removing the trip limit, test vessels will be able to follow the requirements of the testing protocol more efficiently and minimize the cost of field testing and field personnel time in the field. The EFP is outside of the regular fishery and the groundfish and salmon used are not part of the normal pollock fishery and are not subject to the same competitive aspects of the regular fishery. Therefore the management purpose behind the trip limit is not relevant to this project and might unnecessarily constrain our ability to achieve the EFP objectives.
4. Any vessel approved to participate in this EFP, is exempt from a closure prohibiting directed trawl pollock fishing in the Central GOA during the term of this permit. Vessels subject to this exemption may exceed the pollock MRA in Table 11 to 50 CFR 679, during the specified period of the permit.

Proposed catch limits for this salmon excluder EFP

Field work season	MT of groundfish (in pollock target)	Number of Chinook salmon
Winter/Spring 2013 (January 20-May 31)	1,200	1,200
Fall 2013 (August 25-Oct 31)	1,200	1,200
Winter/Spring 2014 (January 20-May 31)	1,200	1,200
Fall 2014 (August 25-Oct 31)	1,200	1,200

Explanation for how the EFP catch allowances were derived:
The proposed amounts of catch shown in the above table per year and per season are what we believe is required to conduct a sufficient number of tows with a standard Pollock net with the excluder and recapture net installed to determine the escapement rates for Chinook salmon and Pollock. The catch amounts are designed to have a high probability of allowing us to estimate excluder performance with meaningful statistical confidence intervals around mean escapement rates for salmon and Pollock. The proposed catch limits for the EFP do not include any "compensation fishing" for the EFP vessels.

The EFP testing plan involves testing the flapper excluder on two different CGOA pollock vessels during two separate testing seasons over a two year period (winter/spring 2013, fall 2013, winter/spring 2014, fall 2014). EFP catch allowances for groundfish are the total amount of catch based on what the two EFP vessels in each field testing season per year would be expected to catch based on doing 12 EFP tows with typical catch amounts of groundfish per vessel in each testing season. It is also important to note that we have designed the testing to include two different size classes because based on our research on salmon excluders in the Bering Sea, we expect there will be differences in excluder shape during towing, water flow rates, and escapement performance between larger and smaller vessels. To ensure we develop an excluder that is effective on both small and large CGOA Pollock vessels, it is imperative that excluder testing occur on vessels typical of the two size classes in the CGOA fishery. For our purposes, the two size classes are in the CGOA are vessels which are in the ≤900 hp and vessels with horsepower of > 900 hp. In terms of how this splits the fleet, we estimate there are approximately 25 vessels in the smaller vessel group and about 10 vessels in the larger vessel group.

Our testing plan incorporates a total of four field testing seasons over a two year period because based on our excluder development work in the Bering Sea, we have seen that multiple field research seasons were needed to arrive at a workable flapper design. The second year of field testing allows us to make adjustments to the excluder based on what was learned during the first year. As mentioned above, we do have a reasonable idea of a starting point for excluder rigging from what was learned in 2011 video work in Kodiak. Relative to research effort needed to develop a workable excluder in the Bering Sea, however, the two years of testing requested in this EFP application is considerably less than the effort that has been needed over eight years with multiple EFPs in the Bering Sea which has finally arrived at an effective excluder. One reason we feel the CGOA excluder can be developed more expeditiously is that the primary salmon bycatch issue facing the CGOA is Chinook salmon whereas in the Bering Sea work on both chum and Chinook has been done over the course of multiple EFPs from 2003-2012. Additionally, the Bering Sea on the flapper excluder is now our starting point for the CGOA pollock fishery and the primary focus in the CGOA is to adapt the excluder to the scale of pollock nets, differences in towing speeds, differences in pollock and salmon catch rates, and other factors that we

have seen can affect excluder performance. Overall, we feel that the adaptation of the excluder to the CGOA is by no means a simple undertaking but the project is expected to be considerably less complicated simply because we now know we can get Chinook salmon to escape a pollock trawl at relatively high rates. The trick is to figure out how to create those water flow and spatial elements in a CGOA polllock net based on the fishing conditions that occur in the CGOA.

Because we are basing the target number of tows for each individual excluder configuration on experimental methods developed for the Bering Sea, some background on the evolution of testing methods is warranted. Our testing in the Bering Sea has relied on different methods over time and those methods have had varying degrees of success. From this experience we have determined that most efficient way to reliably demonstrate the performance of the salmon excluder is to conduct testing with a recapture net. This allows us to measure escapement rates by comparing the number of salmon and weight of Pollock in the recapture net relative to the total number of salmon and weight of Pollock in the tow.

Since the first designs of recapture nets, considerable design improvements to the recapture nets have been made. From numerous tests since then, we feel that these secondary nets appended to the main trawl are the best way to accurately measure escapement rates while minimizing the amount of test fishing needed. We expect that what has been learned in the Bering Sea work about the installation and use of recapture nets is directly and easily transferable to the Gulf of Alaska testing.

<u>How the target number of test tows was derived and expectations for statistical precision:</u>
Prior to 2010, a statistical power analyses were developed to evaluate sample size based on the probability of being able to detect an effect of a predicted magnitude (e.g. a level of reduction in salmon bycatch attributable to the gear modification) at an acceptable level of statistical precision. While rigorous in terms of methods, in retrospect our power analyses likely included inherent bias leading to an overestimation of sample size. This occurred because we lacked good data on the ambient variability in abundance of salmon where EFP testing occurred. Lacking this, proxy values were used based on salmon bycatch rates from the regular pollock fishery. But the regular pollock fishery in all likelihood avoided areas of relatively high salmon abundance. EFP testing, however, was in reality nearly always conducted in areas with relatively high salmon abundance (e.g. inside the rolling hotspots) to increase the chances of being able to measure performance of the excluder.

Testing in areas with higher, more consistent abundance of salmon generally means that there is a higher probability of being able to detect the effect of the excluder on catch rates. This is because haul to haul variability is lower than it would be if salmon abundance were lower and more erratic.

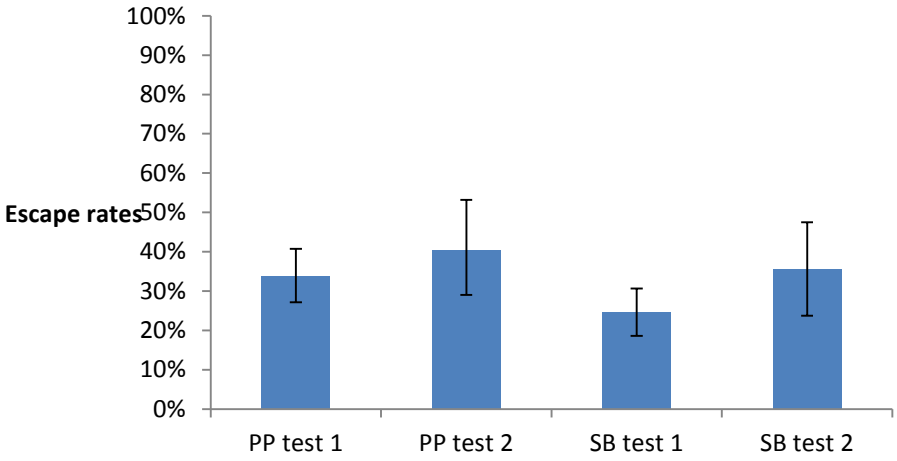
To avoid basing the experiments on a higher sample size than was needed, in our 2010 Bering Sea EFP application (the current Bering Sea EFP salmon excluder permit), we elected to examine recent results to see how many EFP tows it has taken to obtain useful confidence intervals around salmon escapement rates. By incorporating this retrospective examination into the development of the latest Bering Sea salmon excluder EFP application, we modified our approach to sample size estimation based on what we recognized was our “track record” of being able to estimate with reasonable statistical precision escapement rates with approximately 12 test EFP tows with a recapture net.

To illustrate how we came to this conclusion, Figure 3 below shows mean escapement rates and confidence intervals from our testing in winter of 2010. Chinook escapement rates from that winter on CP Starbound and CV Pacific Prince are shown in the figure. The confidence intervals around mean

escapement rates are fairly tight on the first set of tests where 10 tows were done for one EFP vessel and 12 for the other (test results labeled SB test 1 and PP test 1 in the figure). The intervals shown are 95% confidence intervals.

In the second round of tests where eight tows per EFP vessel were done, the wider confidence intervals (for PP test 2 and SB test 2) are illustrative of the likely trade off in precision for measurement of excluder performance in the second round of tests. The second tests were done to evaluate a slightly different excluder configuration.

Figure 3 Chinook escapement rates and confidence intervals for winter 2010 EFP tests



What is meant by an individual test of an excluder "configuration" is that the prescribed number of test tows is made with no (intentional) changes to the excluder device being tested during that set of EFP tows. For example, a configuration would be an amount of weight placed on the flapper panel or a different length of the flapper panel of the excluder. For each test of an excluder configuration, EFP test vessel factors such as towing speed and target amount of pollock per catch per haul are held constant. Because we are interested in how the excluder performs over a range differences in catch rates, however, our testing protocol deliberately incorporates differences in pollock fishing variables such as areas with different target catch rates, day and night fishing conditions, etc. for 12 tows done to test an excluder configuration.

The testing plan for this GOA EFP includes a test of an excluder configuration on a small and large class GOA vessel in the first season and then a second test of a different configuration on each EFP vessel in the second test season based on what was learned in the first test season. Specifically, we intend to conduct testing in the first season and evaluate the escapement rates along with underwater video collected during the test to help us understand fish behavior in response to the excluder. For the second year of the EFP we then would do the testing on an excluder that includes adjustments to the excluder such as changes in the amount of weight on the flapper or the amount of overlap between the flapper panel and escapement portal (affecting how far a salmon or Pollock has to swim forward to escape). Adjustments of this sort would be done to hopefully increase salmon escapement rates or reduce Pollock escapement rates based on the objectives of having an excluder that reduces salmon bycatch rates significantly while being practical in terms of minimizing Pollock escapement as well.

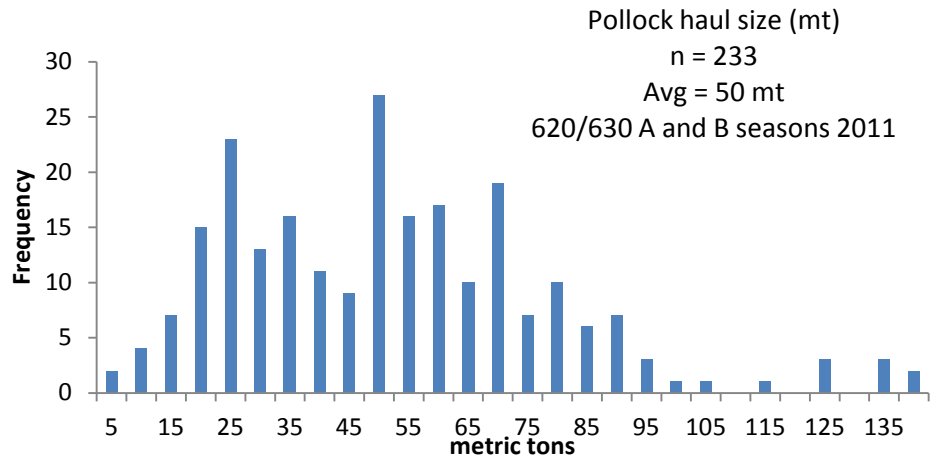
We think this will work in the GOA because based on our experience of multiple field-testing seasons using recapture nets, our testing protocols for the Bering Sea have allowed us to measure escapement in an efficient manner in each test of an excluder configuration using these methods. The desired level of precision in measurement of performance here needs to be understood in the context of applied research. Our methods are not intended to or able to evaluate how every possible covariate affects excluder performance (e.g. day night fishing, high pollock catch rates versus low). The objective is to estimate escapement and present results explaining the set of conditions that were encountered in the testing. An important caveat then is that the captains who may choose to use the device need to know that it may not perform in the same manner as our results depict if fishing conditions different from the ones occurring at the time of the testing.

With all this in mind, our request for what we feel are sufficient pollock and salmon allowances for this Gulf of Alaska EFP application is designed around the catch that would occur while testing the excluder for approximately 12 tows on each of the two EFP vessels for two field seasons during 2013 and 2014.

Catch quantities used to come up with the amounts of groundfish requested in the EFP were based on average catch per tow quantities of groundfish in the regular CGOA pollock fishery in 2011 (source: Alaska Groundfish Databank). We used average catch quantities per haul from the fishery because one of our objectives is to evaluate Pollock and salmon escapement performance under conditions that closely resemble normal fishing conditions. With approximately 50 mt per haul in the CGOA (figure 3), our 1,200 mt of groundfish per testing season allows for approximately 12 tows per EFP vessel per season. Hence 2,400 mt of groundfish is what is needed for the two test vessels per year and two years of EFP testing amounts to a total of 4,800 mt assuming the EFP testing is completed each projected field season.

The distribution of catch amounts per tow in the figure below appears bimodal which likely results from the two vessels size categories described above. During testing, the EFP likely will assign the groundfish somewhat unevenly between the two test vessels in order to accomplish our goal of 12 tows per vessel. This would allow catch per tow amounts to be reflective of what occurs in the regular fishery.

Figure 4 Frequency of pollock haul size in the 2011 Area 630 A/B season pollock fishery



<u>Derivation of the Chinook salmon bycatch allowances requested for the CGOA EFP:</u>

Our expectations for statistical confidence for measuring the salmon escapement performance of the excluder in approximately 12 tows is based on our Bering Sea testing where we deliberately conducted the EFP in areas with above average salmon bycatch rates (generally inside the revolving salmon bycatch hotspot closures). Conducting testing in areas with high salmon bycatch rates is necessary for increasing the chances of having statistical significance for our estimates of mean salmon escapement rates. While a similar formalized program in the Gulf of Alaska is not in place, we intend to use information from fishermen and data from the Alaska Groundfish Databank to target areas with above average changes of salmon bycatch and average catch rates for Pollock in our GOA EFP.

Accordingly, we have come up with a requested number of salmon for the EFP that is an upper bound allowance based on how many Chinook salmon could actually be caught if we are successfully able conduct the test in areas with above average Chinook bycatch rates. At the outset it is important to note that there are recognized problems with observer data estimates of salmon bycatch due to coverage levels and extrapolations. At the same time, however, those data was used by the NPFMC in the setting of the bycatch caps and as far as we know that is the only database that provides estimates of salmon bycatch across a time series of years. Data to look at bycatch rates across a set of years is important because annual variation in salmon bycatch rates occurs.

For our estimate of how many salmon would be needed to accomplish our objectives while avoiding the need for requesting additional salmon for the EFP, we looked at bycatch rates for the CGOA Pollock fishery over the last five years for which data are available (2007-2011, see tables above reproduced from GOA salmon bycatch EA). Total Pollock catch over in the CVOA statistical areas combined during that period was approximately 187,000 metric tons and total estimated Chinook salmon catch was approximately 61,000. That results in an average catch rate of approximately 0.33 Chinook per ton of Pollock catch over that time period. To examine what bycatch rates could be in a high bycatch year, recognizing the limitations to the data, one can look at 2007 where approximately 32,000 metric tons of Pollock were caught in the CGOA and Chinook catch that year was estimated to be 31,000. This comes out to a bycatch rate of approximately one Chinook per ton on average for the CGOA Pollock fishery.

Given the recognized limitations to the observer data on salmon catches in the GOA, we considered how the CGOA's highest annual bycatch rate of one Chinook per ton (2007) compared to the rates in our EFP testing in the Bering Sea Pollock fishery. In our EFP testing in the Bering Sea in 2007 during the Pollock A season, we had a Chinook rate that was close to 0.7 per ton of Pollock in 2007. While the Gulf of Alaska is obviously a different area, we do feel that a rate of one Chinook per ton is likely to be an upper bound in the GOA EFP because it is hard to imagine having bycatch conditions with encounter rates that are as high as in the Bering Sea during the winter of 2007. We were nonetheless able to stay under the one per ton rate in our EFP that year over the course of several weeks of excluder testing.

For the above reasons, we feel that in all likelihood our EFP catches in the GOA EFP will be under the one per ton level. At the same time, using that upper bound rate is appropriate for the environmental analysis (EA) done to evaluate an EFP application because it is a "worst-case scenario" therefore avoiding a situation where the effects of the EFP activities are underestimated. Setting limits for the EFP in this manner also avoids the need to request a change to the EFP permit if bycatch conditions turn out to be at all-time highs over the two years of our excluder testing activities. In past EFPs, NMFS has done all it can to consider and issue modifications to EFPs in a timely fashion. But because test vessels typically have opportunity costs associated with sitting idle over weekends or other periods when NMFS is evaluating requests for modifications, the unfortunate effect can be that the EFP vessel is forced to terminate its EFP activities prematurely. This can result in a failure to achieve sample size objectives and therefore study objectives in spite of all the effort made by the parties collaborating in the EFP.

Disposition of Groundfish and Prohibited Species harvested in conjunction with EFP activities: All retained groundfish caught in conjunction with EFP activities will be delivered to shoreside processing plants in Kodiak and sold. All Chinook salmon caught in conjunction with EFP activities will be retained on the vessel, offloaded at the shoreside processing plant where EFP catches are delivered, and made available for genetic sampling according to the protocols currently in place for the regular GOA Pollock fishery. All salmon that meet the standards of the food bank donation program in place for the GOA will be donated to that program. Any incidental catch of Pacific halibut will be handled in a manner consistent with the regulation pertaining to the GOA Pollock fishery.

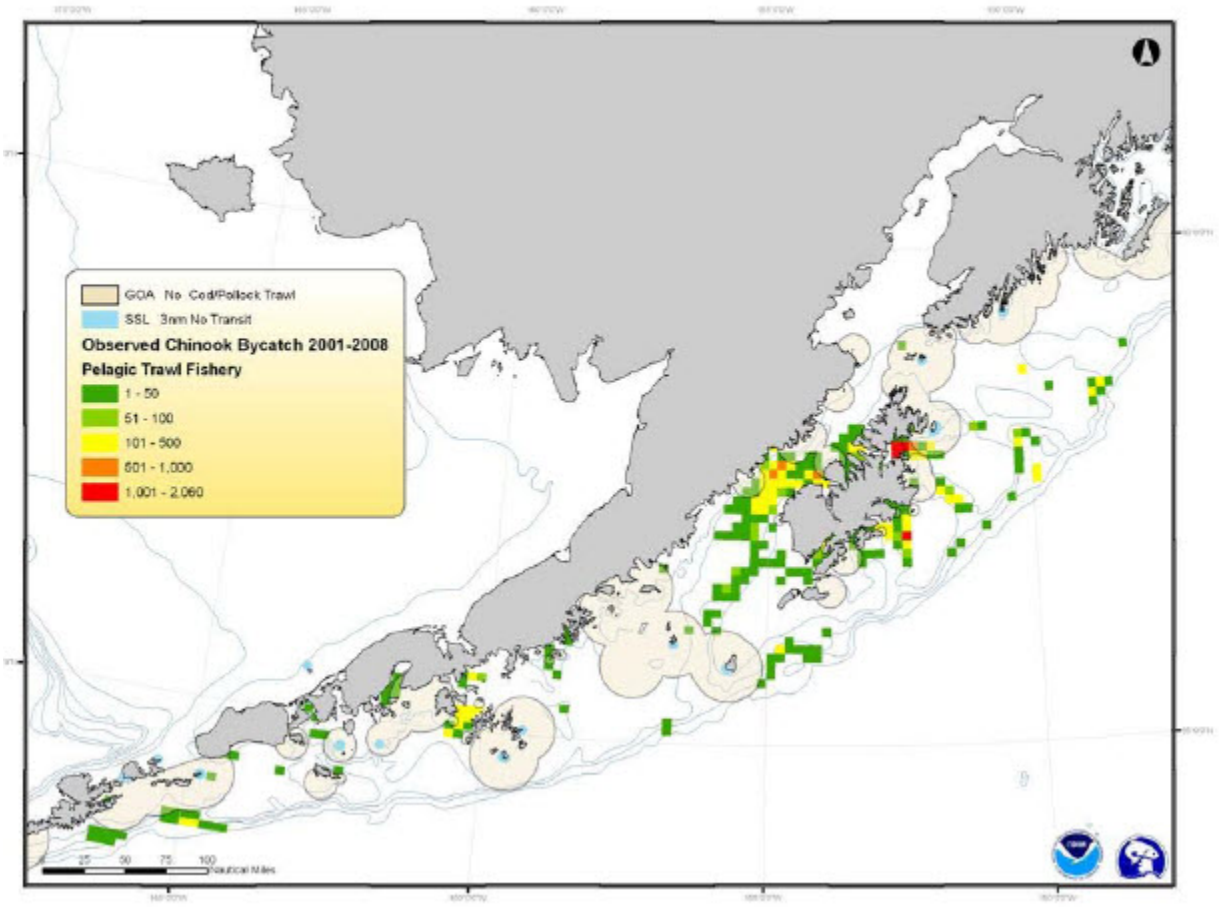
Expected Species Composition for EFP catches: All testing under this EFP will be done with the conventional pelagic Pollock nets used in the Central Gulf of Alaska. Catch composition for Pollock fishing with this net in the CGOA typically results in catches comprised of approximately 96% Pollock and 4% non-pollock groundfish species. We therefore expect catches of non-pollock species will be approximately 4% which would total to about 150 mt of non-pollock groundfish out of the 2,400 mt total catch. The species composition of the non-pollock catches in the EFP is expected to consist of Pacific cod, GOA flatfish species, and squid. Likewise, very low levels of catch of Pacific halibut and crab typically occur in the CGOA Pollock fishery due to the way pelagic Pollock nets are fished in the COA fishery. Our expectation is therefore that EFP catches of halibut and crab will be very low.

Areas where EFP testing is expected to occur during winter/spring and fall 2013 testing: For valid tests of salmon excluders, we need to be able to conduct EFP testing in areas with sufficiently high concentrations of salmon to help ensure that the test will be able to determine the effectiveness of the excluder. We also need to conduct testing where pollock catch rates are representative of actual fishing conditions because we want to evaluate performance in the fishery and in all likelihood pollock catch rates affect excluder performance. Evaluating Pollock escapement rates under normal Pollock catch rates is critical for eventual industry acceptance of the device into their regular fishing activities.

Predicting where adequate concentrations of salmon and pollock will occur from year to year and from season to season is inherently difficult, especially in the Gulf of Alaska. For this reason, it is not possible to specify exactly where the EFP will take place for the two testing seasons in the CGOA (fishing locations in NMFS statistical areas 620 and 630 shown in Figure below).

Prior to testing, the researchers will get input from pollock fishermen as well as examining any available data useful for showing where rates have been highest in the most recently completed pollock fishing season. The figure below from the NPFMC's recent analysis of Chinook bycatch in the GOA pollock fishery shows where salmon bycatch rates on observed hauls have been relatively high over the 20012008 time period.

Observed Chinook salmon prohibited species catch in the pelagic trawl fishery, summed over 2001-2008



EFP Applicant's Assessment of Effects of the EFP on Marine Mammals and ESA-Listed Species

The principle species of concern for effects of harvesting an additional 4,800 mt of groundfish and potential take of up to 4,800 Chinook salmon in the CGOA over the course of 2013 and 2014 are wDPS Steller sea lions, Cook Inlet Beluga whales, southern resident killer whales, and several ESA-listed runs of Chinook salmon in the Pacific Northwest.

To evaluate potential effects, the applicant reviewed the 2010 Biological Opinion for wDPS Steller sea lions and the 2011 Environmental Assessment (EA) done in support of Amendment 93 to the Gulf of Alaska Fishery Management Plan (establishing GOA Chinook bycatch limits). These documents provide current information on the effects of the CGOA Pollock fishery on the environment and the marine mammal and other ESA-listed species mentioned above.

The SSL Bi-op evaluated the effects of federal groundfish fisheries in the EEZ of Alaska as a whole on the WDPS of Steller sea lions. It concluded that the existing CGOA SSL protection measures, made up of closed areas, seasonal TAC apportionments, and other restrictions were adequate in the Gulf of Alaska. Likewise, the EA for Amendment 93 is relevant because it did an exhaustive evaluation of the effects of Chinook bycatch in the Pollock fishery of the Gulf of Alaska over several years including some years when the CGOA Pollock fishery is thought to have caught more than ten times more Chinook than the

2,400 EFP annual upper limit number of Chinook requested for this EFP. The EA for Amendment 93 also examined effects of salmon bycatch on a comprehensive set of ESA-listed species in the GOA, GOA strategic stocks of marine mammals under the MMPA, and effects of Pollock fishing on various salmon species including some "stocks of concern" in Alaska and ESA-listed stocks of the Pacific Northwest.

After reviewing the above analyses, the applicant's conclusion is that the proposed EFP groundfish and salmon bycatch catches, even assuming all of the salmon allowance is taken (an unlikely scenario) would have insignificant and likely too small to be immeasurable effects on wDPS Steller sea lions, Cook Inlet Beluga whales, Southern Resident killer whales, and ESA-listed Chinook salmon from the Pacific Northwest. This conclusion is based primarily on the relatively small scale of EFP catches relative to the much larger removals analyzed in the biological opinion and EA referred to above.

For Steller sea lions, the amount of EFP groundfish harvest (96% of which is expected to be Pollock) by the two EFP vessels operating in each of the two EFP field seasons in 2013 and 2014 amounts to 2,400 mt per year. To put the annual estimated removal into context of the annual estimate of biomass, it is important to recognize that the GOA Pollock biomass was estimated to be approximately 600,000 mt in the 2011-2012 Pollock stock assessment. Additionally, the recommended ABC for that same time period was approximately 125,000 mt. This means that the EFP would result in Pollock removals of a scale that is approximately 0.4% of total GOA Pollock biomass and approximately 2% of GOA Pollock ABC per year in 2013 and 2014.

Pollock is a major prey item for Steller Sea lions in the CGOA according to the 2010 SSL Bi-op. But EFP removals in addition to the regular Pollock fishery still add up to a small fraction of biomass and ABC. Additionally, the EFP fishing will spread evenly between winter/spring and fall in both EFP years (2013 and 2014), amounting to several weeks in each season. For this reason, the EFP fishing is unlikely to have any discernible effect standing alone on in combination with the regular Pollock fishery about which the 2010 Bi-op concluded did not require further restrictions beyond the TAC setting, seasonal apportionments, and closed area measures already in place.

The requested exemption to vessel trip limits of 300,000 lbs for this EFP warrants some consideration because the trip limit regulations are identified as part of the existing SSL protections measures which the Bi-op deemed to be adequately protective for SSL. In reviewing the SSL Bi-op sections relevant to the CGOA, it is evident that the trip limits for Pollock are not a major component of the SSL protection measures in place. Most of the Bi-op's review of existing measures in the GOA focuses on the current set of closed areas, TAC setting process, and safeguards built into the TAC setting process for reducing exploitation rates if stocks fall below the B 20 threshold. The EFP is not requesting any exemptions from the SSL closed areas and other aspects of the SSL regulations and is unlikely to have any implications on whether the Pollock stock in the GOA will dip down to the B20 threshold. In fact, based on the last three stock assessments, it appears GOA Pollock stocks are increasing in abundance. From this, it is important to recognize that GOA Pollock trip limits were not primarily an SSL protection measures and were implemented mostly to resolve equity issues associated with a fishery that is not managed under a catch share program.

Balancing the minor SSL protection aspects of the Pollock trip limits against the need for the exemption for the EFP, the reason the exemption is needed is to improve the EFP's ability to measure the effects of the salmon excluder on Chinook bycatch and Pollock catch rates. In the event that an EFP tow at the end of a trip would exceed the trip limit and require discarding, an exemption allows this outcome to be avoided. Discards during the EFP would prevent good tow by tow accounting of EFP Pollock catches. The means of accounting for Pollock catches per in the vessel's codend against which the Pollock escapement in the recapture net will be compared is explained below.

For the other species of ESA-listed marine mammal and salmon species mentioned above, the effects of interest are for the most part the removal of up to 2,400 Chinook salmon per year in each of the field testing years. While Cook Inlet belugas apparently eat groundfish to some extent, it is the returning salmon that enter the area where Cook Inlet belugas feed that is the potential effect of interest. The GOA groundfish harvests do not affect areas where belugas forage. According to the EA for the GOA Chinook salmon bycatch caps, both Cook Inlet belugas and southern killer whales populations rely heavily on Chinook that are present in the Gulf of Alaska at different life stages. So, for example, if Chinook taken as bycatch or in the EFP in the GOA are bound for the upper Cook Inlet, where runs are at low levels and considered to be a species of concern, (Amendment 93 EA Table 73), then interception of these Chinook in the GOA could have an effect on an important prey for Cook Inlet belugas. Likewise, bycatch of CGOA Chinook could conceivably include Chinook that are prey for southern resident killer whales or could be comprised of Chinook from Pacific Northwest populations which would be a concern.

The Amendment 93 EA evaluates effects on Cook Inlet belugas, southern resident killer whales, and ESA-listed Pacific Northwest salmon runs as well as other effects of GOA salmon bycatch on the species of concern and NMMPA strategic stocks. Table 75 of the EA provides estimates of the proportion of GOA salmon bycatch comprised of the runs bound for the Pacific Northwest and the upper Cook Inlet. Data from coded wire tag (CWT) returns are used to expand these CWT estimates in proportion to overall bycatch numbers in Table 75. The expanded numbers from over 20 years of GOA research surveys are, however, all under 10 with the exception of Willamette River Chinook with totals to 71. Thus according to the conclusions of the EA, the low frequency of CWT returns in GOA Chinook salmon are indicative of a very low probability that GOA Chinook bycatch is comprised of Chinook from these runs. Additionally, the EA analysis includes a discussion of how the numbers include hatchery fish to which the ESA-listing do not necessarily apply.

The overall conclusion in the EA is that the actual numbers of GOA salmon taken as bycatch in the Pollock fishery cannot be determined definitively but is thought to be a rather small number and a small proportion of GOA Chinook bycatch overall. This means that effectively, the GOA Pollock fishery is estimated to take only very small numbers of these salmon species of concern and therefore the downstream effects on belugas and southern resident killer whales is also likely to be proportionally quite small. By extension, the additional possible take of 2,400 Chinook in the GOA per year in 2013 and 2014 seems unlikely to have any measurable effect on the chances of taking additional Chinook from Pacific Northwest runs that are ESA listed or from the stocks that are food for Cook Inlet belugas and southern resident killer whales.

Another consideration in this evaluation is that requested salmon bycatch allowance for the EFP is set based on what could happen if Chinook bycatch abundance is high in 2013 and/or 2014 based on what is thought to have been taken in the Pollock fishery in 2007 and other years of relatively high abundance. As was explained above, the allowance of up to 2,400 Chinoo was designed to be an upper bound annual limit to allow the EFP to occur without needed to request an additional Chinook allowance if 2013 or 2014 are high abundance years for Chinook. In all likelihood, Chinook abundance will be more like the average that has occurred over the 1994-2011 period covered in the EA analysis. In this case, it is highly likely that EFP catches of CGOA Chinook would be considerably lower than 2,400 per year. While the EFP testing will be conducting in areas of relatively high abundance, in years with low or average Chinook abundance, it is still very unlikely that haul by haul Chinook rates in the EFP will be at the one-per ton rate used to derive the limit for the EFP. So in low abundance years for Chinook when an EFP catch allowance of 2,400 Chinook per year might appear to be a large percentage of the Pollock fisheries cap or its actual take, in reality the EFP fishing over just a few weeks in each season is unlikely to catch the 2,400 annual Chinook limit. We have based this conclusion on our EFP testing

experience in the Bering Sea where in 2007 when Chinook abundance in the Bering Sea was very high and spatial overlap of Pollock fishery and Chinook was high, our EFP averaged only 0.7 Chinook per ton. This involved testing on two boats during the peak of Chinook bycatch period for the fishery and in areas deemed to be hotspots based on a bycatch data system that allowed us to zoom in on hotspots.

Administration of the EFP:

The administration of the EFP will follow the same procedures used for the previous salmon excluder EFPs in the Bering Sea. The EFP applicant (permit holder) will be responsible for the overall responsibilities of the EFP including carrying out and overseeing all the field research and associated responsibilities of the EFP. This includes managing the field experiments to make sure that objectives of the EFP are accomplished and staffing field experiments with a qualified field project manager. The EFP applicant will also be responsible for working with the NMFS-certified observer provider companies to ensure the experiments utilize qualified sea samplers. The EFP applicant will ensure that sea samplers are provided with instructions and briefing materials to understand their sampling duties for the EFP.

The EFP applicant (permit holder) will also prepare materials for and conduct periodic meetings to get feedback from GOA pollock captains and gear manufacturers on excluder designs that will be tested during the EFP. The permit holder will present results from the different field work seasons to the pollock industry, North Pacific Fishery Management Council, and other venues to obtain feedback needed for development of the excluder designs. The permit holder will be responsible for data analysis and preliminary and final report drafting in consultation with Dr. Craig Rose of the Alaska Fishery Science Center.

As with the earlier EFPs, decisions on gear modifications to be tested and field testing protocols will be the shared responsibility of the PI and co-investigators. Co-investigators on the overall project to develop a workable salmon excluder are Dr. Craig Rose of the Alaska Fishery Science Center and Mr. John Gruver of the United Catcher Boats Association. The permit holder will be responsible for informing the Alaska Region of National Marine Fisheries Service of field testing dates and required EFP vessel information prior to each field test. Additionally, the permit holder will be responsible for drafting "request for proposals" (RFP) in consultation with AFSC and NMFS Alaska Region personnel involved with the research and other explanatory materials to solicit applications for qualified EFP vessels. The Resource Assessment and Conservation Engineering (RACE) Division of the Alaska Fisheries Science Center will be the lead reviewers of applications by vessel owners interested in providing vessels to conduct the EFP fishing. The Alaska Region of NMFS as well the Fishery Monitoring and Analysis (FMA) Division of the AFSC will also be invited to serve on or otherwise provide input on that review panel.

Testing and catch accounting methods for the CGOA EFP reflecting what is possible on CGOA catcher vessels:

Given the success with excluder development for reducing Chinook bycatch in the Bering Sea, the prospects for successful adaptation in the Central Gulf of Alaska are good. But as our previous experience has underscored, it will be critical to recognize that testing methods need to be rigorous to ensure that we will be able to measure performance differences as we make adjustments based on what is learned in the first testing season.

A critical issue relevant to the success of GOA testing is how to ensure the testing occurs in areas with sufficient salmon bycatch to detect the effectiveness of the excluder. The second issue is how to collect data on GOA boats which tend to be smaller and have considerably less room and more limited

facilities/equipment for collecting data and using video equipment, particularly for data pertaining to individual hauls. These issues are discussed below in the context of how things were done in the Bering Sea testing and the plan for getting as close as we can to haul-specific data collections in the proposed EFP work in the Gulf of Alaska.

One challenge will be using available information to find suitable testing locations. The Bering Sea salmon excluder testing has benefited greatly from the information available from the pollock industry's "hot spot" avoidance program. That program collects and distributes salmon bycatch data on a spatially-specific basis so that areas of relatively high salmon abundance could be located. This has allowed the EFP to locate suitable testing areas efficiently. Having this information allows the testing during the EFP to occur in areas with a relatively high probability of encountering the salmon and pollock catch conditions needed for testing on each EFP tow. This has helped to avoid the problem of using the groundfish provided for EFP testing to explore areas to find suitable testing conditions.

Unfortunately, the CGOA pollock fishery does not have such a system in place and therefore testing will have to depend more on the experience and knowledge of EFP vessel captains for identifying areas with salmon and pollock catch conditions useful for the testing. We will also rely on information from Alaska Groundfish Databank and the Alaska Whitefish Trawlers to locate where fishermen have encountered high salmon catches. Additionally, we will likely conduct excluder testing on the EFP vessels simultaneously whenever possible so that catch data can be shared to help locate areas with good testing conditions. This will be especially important when testing occurs while the regular CGOA pollock fishing is not in operation.

<u>Sampling and Data Collection Activites for the EFP on CGOA Vessels:</u>
To understand the challenges of collecting data on CGOA vessels, it is informative to consider how EFP data have been collected in the Bering Sea salmon excluder testing. In the Bering Sea, we have been able to collect salmon and pollock catch and escapement information on a tow by tow basis. This has been done by accounting for both the escapement from a tow (fish collected in the recapture net) and the total retained catch (fish collected in the regular codend) for each tow. Escapement rates are then determined for that tow by comparing the escapement to the total amount of the Pollock or salmon in that tow. For salmon, escapement performance is the proportion of escapement in terms of number of salmon recovered in the recapture net by species relative to the total number of that species per tow (number in regular codend plus recapture net). For pollock, the weight of pollock in the recapture net has been compared to the total weight of pollock in the tow (recapture net plus regular codend).

In the Bering Sea, accounting for numbers of salmon in the recapture net for each haul has typically been done by dumping the contents of the recapture net into an empty stern tank and accounting for each fish prior to dumping the vessel's codend into a stern tank. Once the recapture net catch is accounted for, the catch in the regular codend is placed in a tank and then moved into the refrigerated storage tanks via a conveyor belt. Salmon are sorted out of the codend catch as they move across the conveyor. In all previous Bering Sea EFPs, this has been done below deck where sea samplers and crew can work in a sheltered area with good lighting and the flow of catch across the conveyor belt can be controlled to allow for accurate identification of salmon in the codend.

To account for the proportion of pollock escapement on each tow, all pollock recovered in the recapture net in Bering Sea experiments have been weighed at the same time the salmon in the recapture net are accounted for. The weight of pollock in the codend is determined by the use of a motion compensated flow scale to weigh all the catch in the codend. To account for catch that is not pollock in the haul, sea

samplers take a normal species composition sample at random intervals and the fraction of non-pollock catch in the ~300 kg random sample has been used to account for the fraction of the main codend catch that is not pollock. We believe these methods allow for an accurate accounting of escapement rates for pollock on a tow by tow basis, especially on catcher processor vessels where similar catch accounting tools are used in the regular pollock fishery.

For Bering Sea catcher vessels, the boats selected for the EFP have generally been vessels with below deck facilities to sort fish on a conveyor belt as the catch is moved to the vessel's refrigerated sea water (RSW) tanks. In many EFP trials on catcher vessels, motion compensated flow scales have been installed for use in the EFP. While not certified by NMFS for catch accounting in the regular fisheries, these flow scale installations are tested on a daily basis during the EFP to ensure reasonable accuracy for the catch accounting objectives of the EFP and overall they have worked fairly well.

The accounting of escapement on a tow by tow basis using the methods described above has provided the opportunity to evaluate escapement rates both under the assumption that tows are independent tests of excluder performance and by pooling catches for EFP tows. This has allowed us to measure variability of the escapement rates and provided the opportunity to informally examine how variables such as time of day, fishing depth, and target catch rates affect escapement rates. In most cases statistical tests have revealed that the escapement results for salmon are only statistically significant across the pooled catch data instead of tow by tow data. The ability to examine escapement data on a tow by tow basis has, however, still been useful for forming hypotheses about covariates affecting escapement such as day versus night differences in escapement rates.

The ability to account for salmon escapement rates on a tow by tow basis has also been useful for removing specific tows where a gear failure occurred such as a torn recapture net. The catch from that specific tow can therefore be removed from the dataset for purposes of data consistency without compromising the integrity of the remaining data from the trip. If collection of tow by tow data were not possible, then the fish from a tow where a gear problem occurred could create problems for using the data from all the catch in the tank.

Based on our assessment of the facilities and practices on catcher vessels in the CGOA pollock fishery, tow by tow data collection presents some challenge but can be undertaken as long as the expectation for precision of data reflects the realities of available facilities on CGOA vessels.

<u>Methods for Accounting for Escapement Of Pollock and Salmon on CGOA Vessels</u>:
Most CGOA catcher vessels have limited deck space relative to Bering Sea catcher vessels but nonetheless these vessels do have sufficient space to account for counts of salmon in the recapture net prior to bringing the codend of the main net on board. An estimate of the weight of pollock escapement (pollock recovered in the recapture net) can be made as well. One way to do this is to place the pollock in observer baskets and count the number of baskets. Very small amounts can even be weighed directly on an observer's scale. For larger amounts of Pollock escapement in the recapture net, volumetric to weight equivalents using totes on deck can be set up prior to the EFP. To do this, an estimate of weight of pollock contained in a tote can be obtained by filling the totes that will be used for the EFP with pollock of the size encountered in the fishery at a shoreside plant prior to the EFP. That full tote can be weighed the pollock on the plant's scales. Precision could be improved if totes are marked with markings corresponding to fill levels and then weighed at the shoreside plant (e.g. quarter ton, half ton etc.).

Two Potential Ways to Account for Salmon in the CGOA Vessel's Codend: In order to account for haul-specific salmon escapement rates, salmon in the codend can be sorted out and counted on each haul. The salmon in the codend are salmon that did not escape (are therefore recovered in the codend instead of the recapture net). Accounting of these salmon on a haul by haul basis allows for comparison of the recapture (escaped) salmon to the total. It will clearly be more difficult to sort out and count salmon in the codend because of the relatively large amount of catch in the codend and the difficulty of sorting them from the pollock and other catch.

For some vessels interested in participating in the EFP, it may be possible to account for salmon in the codend on a haul by haul basis at sea. Candidate vessels with on-deck conveyor belts and sufficient room for running the pollock over the belt on deck prior to dumping the pollock into one of the vessel's RSW tanks might use these sorting belts. Removing salmon from the flow of fish over the belt will require the pace of fish moving over the belt to be relatively slow and will require considerable effort by sea samplers and crew to sort out and account for them.

Alternatively, haul by haul accounting for salmon catches at shoreside plants based on counting salmon by specific tanks corresponding to different hauls may also be feasible for some of the vessels interested in participating in the EFP. This approach may be more workable for vessels that have several separate tanks for holding catch. For EFP applicants proposing to account for salmon catches by tow at the shoreside plant, descriptions of the plan for placing fish into tanks, accounting for which tanks correspond to which hauls, and accounting for salmon by tank (haul) at the shoreside plant will be needed.

Haul-specific estimates of Pollock catch to allow for estimation of Pollock escapement rates by tow. Accounting for catch of pollock in the vessel's codend is the most challenging aspect of EFP catch accounting on CGOA boats. Three approaches are envisioned for estimating tow-specific pollock catches on CGOA vessels. These are described below.

1) No Mixing of Catches from Different Tows Approach: One approach would be not to mix catches from different tows when placing them in tanks and then recording which tows are stored in which tanks. Effectively this would mean that only two or three tows could be made per EFP trip, depending on the number of separate RSW tanks on the vessel. The first tow could be placed in as many tanks as it would take to contain the catch. To do another tow, the EFP vessel would need to have sufficient remaining clean tank space to contain all the catch from the second tow without needing to place any catch in the tank containing fish from the first tow. The same would have to be done for a third tow etc. With this approach, the weight of catch in the tanks corresponding to the different tows would be established at the shoreside plant at the end of the trip. Depending on the number and capacity of the EFP vessel's RSW tanks, using this method for achieving tow by tow catch accounting might be workable on some vessels but difficult to impractical on others.
2) Captain's Hail Approach: A second approach would be to rely on the vessel captain's or sea sampler's hail weight or volumetric estimate of the catch in the codend. Given the relatively short trawl alley on most of the CGOA vessels which require larger codends to be brought up and dumped in sections, this would result in a considerably less precise estimate of total catch than has been used in the Bering Sea EFPs but this still might be useful for gross estimations of pollock escapement rates. In thinking about this approach for our previous experience with Bering Sea salmon excluder EFPs, we have routinely queried captains on an informal basis during the EFP tests to get their estimate of catch amount per tow while the codend is on deck. It has

been interesting to compare these estimates on an *ad hoc* basis to the weight of the groundfish in the codend from the flow scales used for the EFP. While we have not developed any rigorous analyses to look at relative accuracy, generally, captains' estimates have been within 20% of scale weights for typical codend. But notably their estimates have been considerably less precise for smaller and irregularly-shaped codends.

3) Accounting for Pollock Escapement on a Trip Level Approach: Considering the limitations of catch measurement facilities on CGOA vessels, it may be that the only workable approach is to focus our efforts to account for pollock loss rates at the trip rather than tow-specific level. This would involve pooling all Pollock escapement recovered in the recapture net and comparing it to all the Pollock in the trip weighed at the shoreside plant. Collecting data at the trip level could, however, mask some important variability in pollock escapement rates on a tow by tow basis. Likewise we would not be able to look at how salmon escapement rates of different tows related to Pollock escapement on specific tows. This has been an informative in the Bering Sea EFPs where captains are often interested in looking at the results on a tow by tow basis because they can correlate this with the "fish sign" they are seeing on the headrope and downsounders to Pollock escapement percentages on specific tows.

Considering the different methods for accounting salmon and Pollock escapement rates for the EFP in the CGOA, it is important to keep in mind that the most important objective for the EFP is to learn how the excluder affects salmon catches on a tow by tow basis. For that purpose, the focus will be on how vessel's interested in applying to conduct the EFP testing propose to do haul by haul accounting for salmon escapement by either sorting salmon at sea or doing the accounting shoreside by accounting of salmon from tanks used for specific hauls.

Obtaining information on haul by haul escapement rates for Pollock would be highly desirable but each of the three approaches outlined above has potential shortcomings as well as possible feasibility implications for the vessels interested in participation in the EFP. In drafting the request for proposals for this CGOA salmon excluder EFP, the permit holder will work with the scientists and managers who will serve on the application review panel to come up with a ranking of the various approaches to accounting for salmon and Pollock escapement rates at the haul by haul or trip level. In this way, the RFP can help interested applicants understand which methods the review panel feels are workable and how proposals will be scored based on the methods proposed accounting for catches. The EFP will thus be able to select vessels that best achieve the excluder performance data collection objectives of the EFP.